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TITLE: Semiconductor devices constructed from crystallites

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The doping of the GaN collector layer 804 is generally silicon at a level of approximately 5.times.10.sup.18 cm.sup.-3. Its thickness is typically three to five microns. Above the GaN collector layer 804 is a p-type GaN base layer 806 for forming the base of a heterojunction bipolar transistor. The doping and thickness of the p-type GaN layer is typically 50 to 500 nanometers and 1 to 2.times.10.sup.18 cm.sup.-3. The base layer 806 should generally be as thin as possible to reduce the base transit time of the bipolar transistor. Above the p-type GaN base layer 806 is an n-type AlGaN emitter layer 808 for forming the emitter of the bipolar transistor. The aluminum mole fraction of the n-type emitter layer 808 typically ranges from 0 to 20 percent. Its doping and thickness are typically 0.5 to 5.times.10.sup.18 cm.sup.-3 and 0.1 to 2 microns respectively.

FIG. 9(a) shows a cross-sectional view of a heterojunction bipolar transistor under the present invention. FIG. 9(b) shows a top-view of a heterojunction bipolar transistor under the present invention. After the formation of the layers shown in FIG. 8, a cylindrical mesa structure 902 shown in FIG. 9(b) is formed by etching. The depth of this mesa structure 902 should reach the GaN collector layer 804 so that the n-type collector contact

910 may be formed on
it. Then, a second cylindrical mesa structure 904 is formed so that a p-type
base contact 912 may be formed on the GaN base layer 912 as shown in FIG. 9(a).
Then, a third cylindrical mesa structure 913 is formed so that an n-type
emitter contact 914 can be formed on the AlGaN emitter layer 808. The entire
heterojunction bipolar structure is formed in a single hexagonal crystallite
900 as shown in FIG. 9(b).